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Series A

Quarter April 1 - June 30, 1953

## CIRCULATION

TITLE

~~Classification Changed to CONFIDENTIAL~~  
By Authority of DDP-4 Classification Authority  
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SECURITY INFORMATION

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PART E  
HEALTH AND SAFETY  
FROM  
K-25 QUARTERLY REPORT  
FOR FOURTH FISCAL QUARTER  
APRIL 1 - JUNE 30, 1953

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## HEALTH AND SAFETY

### INTRODUCTION

This section treats the various aspects of the plant health and accident prevention programs which are designed to prevent personnel injury or damage of property. Also included in this section are descriptions of emergency planning activities designed to equip the plant for coping effectively with emergency situations which may arise and discussions of the security and plant protection activities designed to provide for protection of classified matter.

Potential hazards at K-25 include not only those inherent in normal industrial and chemical plant operations, but also those due to the corrosive, toxic, radioactive, and fissionable properties of materials which are somewhat peculiar to this plant.

### ACCIDENT AND INJURY EXPERIENCE

#### PERSONNEL

##### Injury Experience

Although the plant worked over 1,000,000 man-hours during a 30-day period without a disabling injury, the 10 such injuries occurring resulted in frequency and severity rates of 3.09 and 0.09, respectively. These values are slightly higher than the respective rates of 2.80 and 0.05 experienced last quarter, but they compare favorably with the plant experience for the past few years. Current injury statistics are compared with those of other recent periods in table E-1, while statistics on disabling injuries are graphically shown in figure E-1.

TABLE E-1  
Injury Experience

	This Qtr.	Last Qtr.	1952	1948 - 1952 (Inclusive)
Frequency Rate, Disabling Injuries	3.09	2.80	2.16	2.87
Severity Rate	.09	.05	.31	.38
Frequency Rate, All Injuries	352	363	387	362
Disabling Injuries	10	9	6.5*	6.8*
Temporary Partial Disabilities**	7	4	6.8*	6.7
{ Sub-major	188	134	178*	
Others	932	1,021	928*	846
Medical Treatment Cases	1,137	1,168	1,121*	858*
Total Injuries				

\*Average per quarter

\*\*In 1951, the AEC redefined the Temporary Partial Disability Classification to include not only Sub-Major Injuries but also the previously considered Medical Treatment Cases involving bone fractures, joint dislocations, and injuries requiring sutures or significant time from work for medical treatment. The quarterly average of Medical Treatment Cases for the 1948-1952 base period includes a majority of the injuries now classified as Temporary Partial Disabilities.

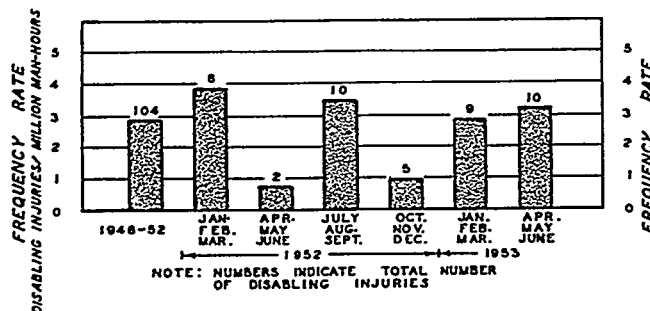


FIGURE E-1  
Disabling Injury Frequency Rates

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## Accident Causes

No significant change in normal accident cause experience was noted, more than 4 out of 5 of all injuries continuing to result primarily from employee acts.

## Radiation Exposure

Of the weekly average of 635 film badges and 187 film rings used, 8 badges indicated exposures above the P.A.L.\*, the maximum reading of any one being 1,080 mrep. The increase over the 3 badges exceeding the P.A.L. reported for the preceding period is attributed to an increase in maintenance on K-1131 Feed Plant equipment containing beta-gamma active material. However, the current result is well in line with plant experience and remains considerably below the 1952 average of 24 such exposures per quarter.

In connection with the routine hand-monitoring program, an average of 665 employees checked their hands daily for alpha contamination, this representing a slight increase from the last quarter when the comparable figure was 638. Although 13 over-P.A.L. hand counts noted represent an increase over the 6 such incidents reported last quarter, the conditions causing them are not considered to represent a significant change in plant conditions.

## PROPERTY DAMAGE

Seventeen property damage incidents, including 7 motor vehicle accidents and 1 minor fire, resulted in a loss of about \$10,000, most of this being due to a crane failure and to 2 explosions, 1 of which damaged the experimental equipment in use and the other of which caused extensive damage to a building and the enclosed equipment. This loss figure is above both the low \$574 loss of last quarter and the average quarterly loss for the past 2 years.

## MATERIAL RELEASES

As in the preceding quarter, 8 material releases occurred, 4 involving radioactive materials; of these, 1 was responsible for considerable building contamination. A total loss of about \$44,500 was involved in these releases, most of this being due to a single incident in which a considerable amount of process coolant was lost.

## ACCIDENT PREVENTION ACTIVITIES

### PROTECTIVE FACILITIES AND EQUIPMENT

#### Property

*Permanent Fixtures.* The installation of 2 new constant water samplers in the Clinch River and in Poplar Creek provides an improved means for detecting possible releases of radioactive materials from the plant and eliminates the need for frequent spot sampling.

New fire mains and associated equipment for the K-1420 Decontamination Building and the K-33 fire water system were completed and placed in service. Sprinkler systems in the tube storage area of the K-31 Process Building and in the Maxon construction area were tied in to the K-25 Plant fire alarm system.

*Movable Equipment.* Two new fire pumpers have been placed in service, replacing 2 similar depreciated trucks.

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\* Plant Acceptable Limit

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The 2 alpha survey meters and 32 beta-gamma survey meters received bring the total number of such plant instruments to 222 and 150, respectively.

*Equipment Failure.* The 28 interruptions with 652 hours outage affecting the plant fire water system represent a decrease from the 39 interruptions with 1,065 hours outage reported last quarter, this representing continued normal experience.

An electrical fault in a process motor resulted in the failure of a 1200/1600 kva. transformer but caused no serious interruption of operations.

An outage of a boiler at the K-701 Power House resulted from the rupture of 1 of its water tubes.

A significant crane failure occurred when a cable cross-wound on the drum and was severed, dropping the load and producing considerable damage to the building floor. Another load drop resulted from the operation of a monorail hoist with too short a cable.

Cracks requiring repair or replacement of the parts involved occurred in a desuperheating station at the K-701 Power House and in the high pressure side of an air compressor at the K-1201 Air Plant.

## ENGINEERING DESIGN, TESTS, AND SPECIFICATIONS

### New Construction and Alterations

Major facilities receiving specific accident prevention consideration include the K-33 Plant, additions to the K-1037 and K-1100 Barrier Manufacturing Plants, the K-1420 Decontamination Building, the continuous extraction and recovery system in the K-131 Building, the K-1131 Feed Manufacture Building, K-1004-A Laboratory, K-413 Side Withdrawal Building, K-1400 Maintenance Office Building, and the K-31 Plant storage area.

### Special Hazards

Eleven approval letters concerning equipment installations or changes in operational methods were issued.

Recent experimental criticality information for uranium material of 5% U-235 assay has necessitated a downward revision in the volume and mass of the previously suggested design figures; the suggested "always-safe" cylinder diameter for this assay remained unchanged.

Design specifications for the Portsmouth Plant and for the equipment changes in the K-25 operations area have been revised upward with respect to the assay gradient, necessitating re-examination of the various facilities with respect to continued nuclear safety.

## QUALIFICATION TESTS

About 96% of the 221 employees given tests for motor vehicle operator's permits were found to be qualified. Welder's qualification tests were passed by 64% of the 348 Carbide employees and by 73% of the 1,410 subcontractor employees taking them.

## EDUCATION AND PROMOTION

Subjects receiving emphasis through the use of safety and educational films included water safety and various aspects of radiation. Calendar inserts and plant slogan boards were utilized to em-

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phasize good housekeeping.

The 221 safety meetings held throughout the plant represent no appreciable change from the number held during the previous period.

## **PLANT EVALUATION**

### **ROUTINE INSPECTION**

#### **Mechanical Inspection**

Unusual conditions revealed during the annual inspection of 4 of the 6 boilers at the K-1501 Steam Plant included bulging on a furnace wall tube and plugging of a tube to a degree which necessitated replacement. A general heavy sludge condition was found on the internal surfaces of 3 of the 4 boilers.

An overspeed device on a diesel unit in the K-1101 Air Plant was found to be inoperative as was 1 of the 4 overspeed devices on the K-1501 Steam Plant boiler feed pump turbines.

#### **Fire Protection**

The completed semiannual inspection of the 230 plant fire hydrants and the routine tests of the sprinkler systems showed all of them to be operable although minor mechanical repairs were needed in some cases. The bimonthly inspections and tests of units of the fire alarm system revealed 5 master alarm boxes to be inoperable.

#### **Radium Source**

Routine checks of the 24 radium sources in the K-25 Plant showed no evidence of radon leakage.

### **PLANT CONDITION AND AUDIT**

#### **Fire Protection**

The removal of combustible materials from storage in the K-27 basement and the cell floor of the K-29 Process Building represents appreciable improvements in the fire protection picture within the plant.

The spraying of cocoon paint, which is highly flammable during the spraying operation, was completed in the K-402-1 Process Building pipe gallery without incident.

Improved storage was provided for hydrogen cylinders in the K-27 Switch Yard with the construction of sheds for this purpose.

#### **Electrical Inspection**

Audits of electrical installations in the plant have indicated that, in general, such work is being done in accord with applicable standards and none of the failures of major items of electrical equipment have resulted in major production interruption in the plant or have involved unusual conditions requiring major changes for correction. In connection with the continuing program of having all electrical circuits identified from their primary feed points to their utilization points, the identification of approximately 94% of the circuits has been completed.

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### Special Hazards

Two significant incidents were formally reviewed, one involving the use of water for extinguishing cold trap fires and the second concerning a  $UF_6$  condensation in cascade piping during a transfer operation.

### Health Physics

**Alpha Contamination.** The alpha contamination problem in the plant as reflected by surveys of the 30 locations having major contamination problems continued to increase, the average area and hazard indices\* being 47 and 560, respectively, as compared with the corresponding previous values of 46 and 388. This increase is attributed primarily to a build-up of radioactive materials from normal operations in the K-1131 Feed Manufacture Building and in the K-631 Disposal Building, to the use of the  $UO_3$  drying unit in the K-1413 Design and Development Building, and to a release of material following an explosion in the K-413 Building. The upward trend in contamination for plant locations having major contamination problems is shown in figure E-2, where both the area index\* and the hazard index\* are indicated.

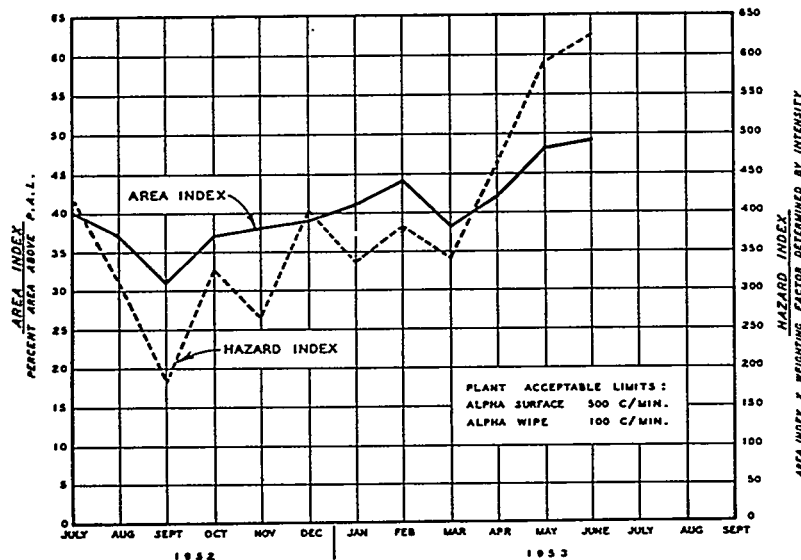


FIGURE E-2

**Penetrating Radiation Levels.** Only slight changes were noted in the penetrating radiation levels this quarter; the personnel-exposure potential\*\* decreased slightly from 1.13 to 1.04, whereas the average film badge reading increased slightly from 25 mrep/wk. to 28 mrep/wk. The increased exposure as well as the larger number of over-P.A.L. badges reported under Accident and Injury Experience were attributed partly to a larger number of maintenance jobs on K-1131 Feed Plant equipment containing beta-gamma emitting materials.

The personnel-exposure potential and the actual personnel exposure as indicated by film badge readings are shown in figure E-3.

\*The alpha contamination hazard index is a figure which reflects the product of the extent and the intensity of contamination exceeding the P.A.L.; the alpha contamination area index is essentially the fraction of the area which is contaminated in excess of the P.A.L. and thus reflects the extent of contamination only.

\*\*The personnel-exposure potential is a figure reflecting the average radiation dose rate in the highest level locations and the number of personnel assigned to those locations.

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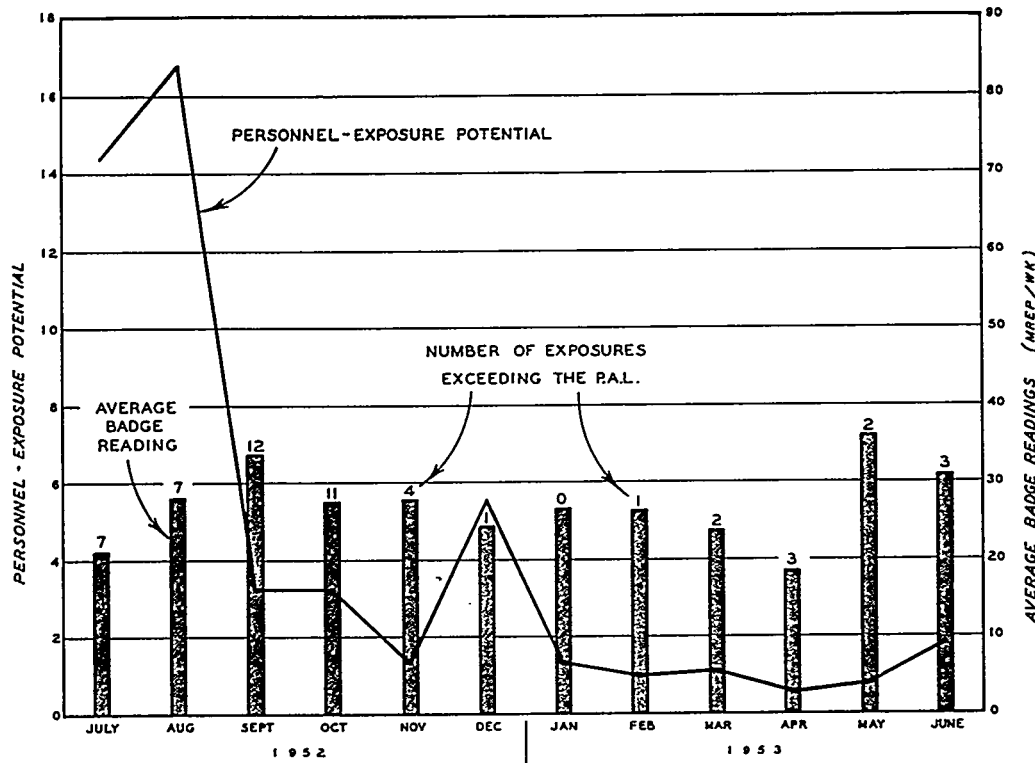


FIGURE E-3

The Average of the Maximum Penetrating Radiation Intensities  
and the Average Film Badge Reading in 5 Selected Locations

*Air Activity Levels.* The average air activity in the 9 locations where shift-length air samples are routinely taken decreased from 0.07 counts/min./ft.<sup>3</sup> to 0.05 counts/min./ft.<sup>3</sup>. Only 2, or 0.11%, of the 1,772 samples taken exceeded the P.A.L., the corresponding fraction last quarter being 0.29%. This decrease is attributed to the drop in levels of the K-1410 Decontamination Building resulting from improved operational methods for handling the K-1131 ash receivers.

*Water and Stream Bottom Survey Program.* The average beta activity in the treated sanitary water supply was 26 dis./min./100 ml. during this period as compared to 73 dis./min./100 ml. reported last quarter. The peak activity reached during May, 62 dis./min./100 ml., is considerably lower than the peak of 219 dis./min./100 ml. reported last period. The decrease is due to the reduced quantity of fission products released to the Clinch River from the storage lake of another installation upstream and to the lower beta activity found in that lake.

The average uranium concentration in Poplar Creek mud increased from 27 ppm. to 48 ppm. during this period. This concentration is attributed to the washing of floor areas in the plant and, although the increase gives a result significantly above recent plant experience, it is not considered to present an immediate health problem. The concentration in the Clinch River water remained unchanged at about 0.70 ppm.

## INDUSTRIAL HYGIENE

The number of employees included in the industrial hygiene urinalysis program continued to increase although the total number of analyses reported decreased 7%, with a 16% decrease in the urinary uranium determinations alone. This latter figure was largely influenced by the increased effort on

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the part of line supervision to reduce the number of employees with repetitious positive uranium findings and the beginning of the vacation season.

There was a further increase in the positive urinary uranium findings traceable to the Feed Plant. Seventy-one per cent of all positive findings was the result of employment in the Feed Plant or its supplemental operations. All the employees selected from a large group involved in a major gaseous release, which drifted from the Feed Plant into other work areas, showed temporary urinary uranium.

Three gaseous material releases in different areas of the plant involved personnel employed within the plant area by another contractor. These employees are not included in the routine industrial hygiene program but when examined following these exposures showed low level urinary uranium.

The urinary plutonium program for the maintenance and operating personnel in the Feed Plant has been enlarged, in keeping with evidence of the presence of plutonium in ash accumulations in the equipment.

Failure to note the change in the physical dimensions of a work area resulted in the serious over-exposure of 2 employees to carbon monoxide.

New pieces of equipment acquired for use in work area evaluation are a smoke sampler and an oscillating thermal precipitator.

Special projects and investigations worked on during the quarter were: (1) Isolation of the source of the irritating fumes from the (2) Ventilation of the axial flow compressor maintenance pits. (3) Improvement of the ventilation of the central cleaning area degreasers. (4) Ventilation and collection of dusts and fumes from the scrap barrier grinding and melting operations. (5) Further development of the solvent cleaning of electric motors without service interruption as well as those removed from their mounts.

The composite findings of the industrial hygiene program are presented in tables E-2 and E-3.

**TABLE E-2**  
**Urinary Contaminants**

Contaminant	Maximum Allowable Concentrations	Total No. of Analyses	Positive Findings	
			IND.	VMR.
Alpha Activity	10 c./min./100 ml. Recalled if above 3 c./min./100 ml.	1,453	18	20
Fluorides	4 mg./liter. Recalled if 2.0 mg./liter.	912	17	6
Lead	0.10 mg./liter	15	0	0
Mercury	0.10 mg./liter	158	2	0
Plutonium	3.5 c./min./24-hr. specimen.	163	3*	0
Uranium	Not determined. Recalled if above 0.005 mg./liter.	1,491	232	60

\*These specimens exceeded 0.7 c./min./24-hr. specimen.

IND. Urine specimens submitted in scheduled Industrial Health Examination.

VMR. Urine specimens submitted following suspected material releases or absorption.

**TABLE E-3**  
**Air-Borne Contaminants**

Contaminant	Maximum Allowable Concentrations	Total No. of Analyses	Positive Findings
Acetone	500 ppm.	5	0
Ammonia	100 ppm.	2	0
Aldehydes	5 ppm.	1	0

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TABLE E-3  
Air-Borne Contaminants  
(Continued)

Contaminant	Maximum Allowable Concentrations	Total No. of Analyses	Positive Findings
Cadmium	0.10 mg./m. <sup>3</sup>	4	0
	2.5 mg./m. <sup>3</sup>	15	4
Carbon Monoxide	100 ppm.	31	4
Coolant*	1000 ppm.	1	0
Dusts (non-silica)	15 mg./m. <sup>3</sup>	2	0
Fluorine	1 ppm.	31	12
Hydrogen Chloride	5 ppm.	2	0
Hydrogen Fluoride	3 ppm.	19	6
Mercury	0.10 mg./m. <sup>3</sup>	50	6
Lead	0.15 mg./m. <sup>3</sup>	3	0
Nickel	0.5 mg./m. <sup>3</sup>	23	13
Nickel Carbonyl	1.0 ppm.	1	0
Trichloroethylene	200 ppm.	7	4
Uranium	0.15 mg./m. <sup>3</sup>	58	4

\*Decafluorobis Cyclohexane.

### EMERGENCY PLANNING ACTIVITIES

The 7 surprise plant-wide emergency drills conducted during the quarter included problems involving an explosion, 2 critical reactions, 2 power failures, and 2 chlorine releases. In addition, 29 local emergency drills, as conducted by shift personnel, consisted of 6 toxic gas releases, 3 rescue and first aid problems, 12 fire drills, and 8 simulated operational failures.

These emergency drills were designed to include problems that could occur at any time in the plant and which require area evacuation, communications and security control, personnel rescue and treatment, and operational difficulties. The plant continues to show improvement in the planning, staging, and handling of these emergencies.

In connection with the emergency assistance policy, K-25 fire equipment made 9 practice runs to Y-12 to determine the running time between plants and to familiarize personnel with the routes and portals. Aid in combatting a warehouse fire was given Y-12 on one occasion.

Fire fighting equipment responded to 50 alarms and 36 drills, and the emergency truck responded to 2 alarms and 21 drills.

Air blast horns have been installed and placed in service in the K-29 and K-31 buildings for evacuation purposes.

Two hose houses equipped with sufficient hose and spray nozzles were installed in the vicinity of K-1131 for controlling possible releases of certain toxic gases.

### PLANT SECURITY

#### SECURITY PRACTICES

##### Clearances

Security clearances were obtained for 275 prospective K-25 employees while 545 such clearances were pending at the end of this period. Similarly, 544 clearances were obtained for subcontractor and vendor personnel with 1,056 pending.

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### Subcontractors

Sixteen facility clearances have been requested for the purpose of bidding on classified contracts. Two classified contracts were awarded in conjunction with the expansion program.

Supplemental security information for personnel history files was requested from all vendor personnel cleared prior to January 1, 1950.

The investigation of a broken seal on a boxcar containing material for a subcontractor indicated that there had been no attempted sabotage.

### Revisions and Changes

An improved procedure for handling the security aspects of unscheduled or emergency shipments of classified material to other AEC installations has been established.

## PLANT SECURITY EVALUATION

### Significant Items

An investigation by the Federal Bureau of Investigation of a possible sabotage attempt failed to reveal any evidence of subversive activities.

### Audits

The 81 classified repositories found open and unattended on audit checks indicate essentially no change from previous experience.

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